

Carbohydrate Ingestion During Resistance Exercise Elevates Blood Glucose and May Improve Muscular Endurance but Not Maximal Strength or Power: A Randomised, Placebo-Controlled, Workload-Matched Crossover Trial

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Abstract

Background: Carbohydrates are among the most frequently used nutritional supplements to enhance exercise performance and recovery, yet their acute effects during resistance training remain less clear.

Methods: In a randomized, placebo-controlled crossover trial, 15 resistance-trained participants performed two workload-matched full-body resistance sessions (leg press, knee extension, cable crunches, lat pulldown, bench press; 80% 1RM) 3 hours after a standardized breakfast ingesting 60 g carbohydrate or placebo. Participants rated their perceived exertion, affective state and gastrointestinal distress during exercise. Drop jumps, isometric handgrip strength, muscular endurance (knee extension to failure), blood glucose and lactate were assessed post-exercise.

Results: Sixteen participants were randomised and 15 analysed. Carbohydrate ingestion elevated blood glucose (+ 19.0 mg/dL; 95% CI 8.12–29.88; $p = .002$) without increasing lactate, while subjective and strength outcomes were unaffected. Knee extension repetitions were higher after carbohydrate ingestion for the dominant leg (+ 2.7 repetitions; 95% CI 0.07–5.33; $p = .046$) but not for the non-dominant leg (+ 2.4 repetitions; 95% CI – 0.45–5.25; $p = .089$). The difference in glucose between intervention and placebo was associated with body height but not pre-exercise caloric intake.

Conclusions: Intra-workout carbohydrate ingestion raises blood glucose without increasing lactate at a matched workload. A benefit for muscular endurance was observed for the dominant leg only and was not statistically significant for the non-dominant leg; maximal strength and power were unaffected. These exploratory findings require confirmation in an adequately powered trial.

Study Registration: German Clinical Trials Register (registration date: 27.04.2026; DRKS-ID: DRKS00038810)

Background

Carbohydrates are among the most frequently used nutritional supplements to enhance exercise performance and recovery [1]. In contrast to the overwhelming evidence supporting their efficacy in endurance sports, knowledge regarding their effectiveness and necessity during resistance training remains considerably weaker [2, 3].

Current evidence suggests that beneficial effects of carbohydrate supplementation might be limited to exercise sessions performed in the fasted state, particularly when the last meal was consumed at least 8 hours before training. In contrast, acute performance-enhancing effects of carbohydrates are widely believed by gym-goers [4], and the International Society of Sports Nutrition generally recommends carbohydrate supplementation during resistance exercise rather than exclusively after prolonged fasting periods [5].

The discrepancy between scientific evidence and real-world practice may be attributable to the limited number of studies employing ecologically valid study designs, particularly regarding exercise

combinations including upper and lower body exercises and the consistent ingestion of carbohydrates throughout rather than just before workouts [2, 3]. Furthermore, most studies have compared achieved workload between carbohydrate and placebo conditions rather than standardizing workload to enable assessment of muscle force production and fatigue as well as subjective and metabolic responses [3]. Consequently, changes in performance may have led similar strain, making it difficult to detect supplementation effects on such outcomes. Future research should therefore aim to differentiate between effects on exercise workload and parameters reflecting physiological or perceptual strain when workload is matched between carbohydrate and placebo conditions.

The present study compares a workload-matched full-body resistance training session performed with and without carbohydrate supplementation in a placebo-controlled randomized crossover design. The study applies an ecologically valid design by investigating postabsorptive exercise conditions following 3 hours after a breakfast, which is standardized between conditions. We hypothesize that carbohydrate supplementation will result in lower perceived exertion during exercise, improved post-exercise muscular performance, and higher capillary blood glucose and lactate concentrations.

Methods

Trial Setting and Public Involvement

The study was conducted at the Department of Sports Sciences, Goethe University Frankfurt, utilizing specialized laboratory and gym facilities. Approval for the study was obtained from the Ethics Committee of Department 5 (Psychology and Sports Sciences) of the Johann Wolfgang Goethe University Frankfurt am Main (approval date: 15.02.2026; ID: 2025-79). The study was prospectively registered in the German Clinical Trials Register (registration date: 27.04.2026; DRKS-ID: DRKS00038810). All procedures were carried out in accordance with the ethical standards of the Declaration of Helsinki. Sport science students contributed to the development and refinement of the study design, focusing on feasibility and practical implementation; however, they were not involved in data analysis or interpretation. Participants were recruited from the local physically active community. All exercise testing, supervision, and data collection were performed by trained members of the research team. This study adheres to CONSORT guidelines and includes a CONSORT flow chart (Fig. 1).

Trial Design, Randomization, and Sample Size

This was a randomized, placebo-controlled, crossover trial comprising two periods and two sequences (carbohydrate → placebo and placebo → carbohydrate) with 1:1 allocation investigating the acute effects of carbohydrate (CHO) ingestion during resistance exercise on performance, fatigue, subjective responses, and metabolic parameters. The random allocation sequence was generated by a member of the research team using computerized simple randomization, without blocking or any other restriction. Beverages were prepared and labelled according to the randomization schedule by a person not involved

in testing, so that the allocation was concealed until the intervention order was assigned. The trial was single-blind: participants were blinded to the beverage content, whereas the investigators supervising the sessions, the outcome assessors and the person performing the statistical analysis were not blinded. As an exploratory superiority study, the sample size ($n = 15$) was determined pragmatically to assess feasibility, estimate effect sizes, and provide preliminary evidence of the intervention's efficacy. A crossover design was chosen because resistance training status is stable over the short trial period and the acute effects of a single carbohydrate bolus are fully reversible within the interval between sessions. Since between-participant variability in muscular strength is large relative to the expected within-participant effect, using each participant as their own control increases statistical efficiency.

Participants

Eligible participants were aged 18 to 40 years with at least one year of resistance training experience. Exclusion criteria included the use of perception-altering substances, acute or incompletely rehabilitated injuries, and severe cardiovascular, pulmonary, renal, neurological, psychiatric, or musculoskeletal disorders. All participants provided written informed consent. Enrolment was handled by the research team, with personnel gaining access to the allocation sequence only after inclusion and scheduling. Participants remained blinded to the beverage content throughout the intervention. Recruitment took place between 01.05.2026 and 30.06.2026.

Intervention and Comparator

Participants completed two experimental conditions: carbohydrate supplementation and a placebo, separated by a washout period of at least three days. This interval was chosen to allow restoration of muscle glycogen stores and recovery from the acute fatigue induced by a single resistance training session; since delayed onset muscle soreness was not assessed, residual fatigue in the second period cannot be fully excluded. Each session comprised five resistance exercises: leg press, knee extension, abdominal cable crunches, lat pulldown, and bench press. All exercises were performed at 80% of the individually estimated one-repetition maximum (1RM). The 1RM values were predicted during a familiarization visit using the Brzycki formula (Brzycki formula: $1RM = 100 \times \text{weight lifted} / (102.78 - 2.78 \times \text{number of repetitions performed})$) [6].

In the first session, participants performed each set to volitional fatigue. In the second session, the absolute workload (load and repetitions) of the first session was replicated to ensure identical training volume between periods. This ordering was fixed: the session performed to volitional fatigue was always the first period, whereas the allocated beverage was randomised.

The carbohydrate beverage contained 60 g of maltodextrin (HSN Nutrition), 0.5 g of citric acid, and 0.5 g of sodium chloride dissolved in 500 mL of water. The placebo was identical in composition but omitted the carbohydrates. Maltodextrin was used because it is largely tasteless, so that the two beverages were

matched in appearance and taste. Participants consumed the full 500 mL (100 ml during each exercise) of the allocated beverage during the session in both conditions. Interventions were conducted between 12:00 and 14:00 h to control for circadian rhythms. Nutritional intake was documented via a structured dietary protocol from 18:00 h the preceding day, with the final pre-exercise meal consumed 3 hours before testing.

Outcomes

The pre-specified primary outcomes were post-exercise performance across three domains: (1) drop jump performance from a 30.5 cm box (three trials), (2) isometric maximal handgrip strength using a Jamar dynamometer (three trials), and (3) muscular endurance, defined as the number of unilateral knee extension repetitions performed to volitional fatigue at 80% 1RM and assessed separately for the dominant and the non-dominant leg. Secondary outcomes included post-exercise blood glucose (Sinocare) and blood lactate (Lactate Scout) concentrations via earlobe capillary sampling. Additionally, the Borg Rating of Perceived Exertion (RPE) [7], Feeling Scale (subjective well-being) [8], and assessments of nausea and gastrointestinal discomfort, on a numerical rating scale ranging from 0 ("no discomfort") to 10 ("maximal imaginable discomfort"), were recorded once during each of the five exercises. The post-exercise test battery started two minutes after the final set of the last exercise and was performed in a fixed order: drop jumps, isometric handgrip strength, and knee extension to volitional fatigue. Capillary blood samples for glucose and lactate were taken immediately after the muscular endurance test. The outcomes reported here correspond to those pre-specified in the trial registration (DRKS00038810); no outcomes were added, dropped or redefined after the trial commenced. Safety was systematically monitored by trained investigators. Participants were instructed to report any adverse events, including musculoskeletal complaints, excessive fatigue, or dizziness.

Statistical Methods

Data were analyzed using paired t-tests or Wilcoxon signed-rank tests, depending on the distribution and model assumptions. Continuous variables are presented as means, standard deviations, and ranges. Analyses followed a complete-case approach, including all participants who finished both conditions, as the paired testing procedures require complete data pairs and exclude cases with missing values listwise; a per-protocol analysis was therefore applied by necessity. Exploratory correlational analyses were performed where appropriate to further characterize the metabolic and performance responses, using Pearson's or Spearman's rank correlation coefficients depending on the distribution of the variables involved. Because all comparisons were based on within-participant differences, period and carryover effects were not formally modelled; the washout of at least three days between sessions was intended to preclude carryover of the acute intervention. Because the session performed to volitional fatigue was always the first period, period effects could not be separated from the workload-matching procedure by design. The dominant and the non-dominant leg were analysed as two separate outcomes without correction for multiplicity, in keeping with the exploratory character of the study. Because the

number of complete data pairs differed between outcomes, the denominator is reported for each outcome in Table 2. All statistical tests were two-tailed, with the significance level set at $p<.05$.

Table 2

Psychometric and physiological outcomes presented as mean $\pm$ standard deviation (SD) and range (minimum–maximum) for the intervention (60 grams of maltodextrin) and control (0 grams of maltodextrin) trials. Outcomes included the Feeling Scale, Borg Rating of Perceived Exertion, Reactive Strength Index, handgrip strength (kilograms, kg), knee extension repetitions to exhaustion at 80% of the one-repetition maximum (1RM), blood lactate (millimoles per liter, mmol/L), and blood glucose concentration (milligrams per deciliter, mg/dL). Normality was assessed using the Shapiro–Wilk test (W, p-value). Knee extension repetitions are reported separately for the dominant and the non-dominant leg. Group comparisons were performed using paired t-tests or Wilcoxon signed-rank tests, as appropriate (t-value, p-value, Cohen's dz). Descriptive and inferential statistics are based on the participants with complete data pairs for the respective outcome; the denominator is given with each outcome. The 95% confidence interval (CI) for mean differences is reported. Significant differences are indicated by an asterisk (*).

Outcome	Intervention	Control	Shapiro-Wilk (W; p)	T-test (t; p; d) 95% CI Mean diff.
Feeling Scale (– 5 to + 5; n = 13)	1.88 $\pm$ 1.26	1.46 $\pm$ 1.17	I: 0.91; .210	1.36, .198, 0.38
	0.20–5.00	–0.60–3.00	C: 0.91; .208	–0.25 to 1.08
Perceived Exertion (Borg, 6–20; n = 15)	14.08 $\pm$ 1.48	14.73 $\pm$ 1.35	I: 0.97; .871	–1.91, .077, –0.49
	11.60–16.80	12.40–17.40	C: 0.99; 1.000	–1.39 to 0.08
Drop Jump (Reactive Strength Index; n = 15)	1.57 $\pm$ 0.35	1.61 $\pm$ 0.39	I: 0.98; .938	–0.59, .566, –0.15
	0.96–2.16	0.97–2.21	C: 0.94; .337	–0.18 to 0.10
Handgrip Strength (kg; n = 15)	44.53 $\pm$ 11.48	45.87 $\pm$ 10.22	I: 0.94; .356	–1.10, .292, –0.28
	29.00–67.00	30.00–65.00	C: 0.96; .652	–3.94 to 1.28
Knee Extension, dominant leg 80% 1RM (Reps; n = 10)	11.00 $\pm$ 2.36	8.30 $\pm$ 3.37	I: 0.95; .622	2.32, .046*, 0.73
	7.00–15.00	2.00–13.00	C: 0.96; .828	0.07 to 5.33
Knee Extension, non-dominant leg 80% 1RM (Reps; n = 10)	10.90 $\pm$ 2.77	8.50 $\pm$ 3.21	I: 0.88; .140	1.91, .089, 0.60
	8.00–15.00	2.00–13.00	C: 0.95; .674	–0.45 to 5.25
Capillary Lactate (mmol/L; n = 14)	4.15 $\pm$ 1.68	4.39 $\pm$ 1.93	I: 0.89; .089	–0.70, .494, –0.19
	1.80–7.50	2.30–9.90	C: 0.82; .008*	–0.99 to 0.50
Capillary Glucose (mg/dL; n = 15)	104.33 $\pm$ 14.28	85.33 $\pm$ 10.33	I: 0.89; .058	3.74, .002*, 0.97
	81.00–143.00	58.00–100.00	C: 0.92; .199	8.12 to 29.88

Results

Sixteen participants were randomised, eight to each intervention sequence (carbohydrate → placebo and placebo → carbohydrate). Fifteen of the sixteen randomised participants completed both the control and the intervention trial (Fig. 1). One participant was excluded because of a shoulder injury acquired between baseline testing and the first trial and therefore contributed no data to either period.

Recruitment ended once the planned number of participants had completed both experimental sessions wash-out period was in a range of 3 to 15 days (median 7). Participant characteristics, resistance workout experience, exercise trial characteristics, and pre-intervention nutritional data are shown in Table 1 for the sample as a whole; baseline characteristics were not analysed by sequence. Both exercise trials were conducted at the same time of day, with all participants starting between 12:00 and 14:00 h. Trial duration was kept constant across both conditions. Participants adhered to the pre-exercise nutrition standardization by replicating the same meal schedule before both trials. As participants were instructed to choose a meal they considered appropriate for exercise performed 3 h later, energy, carbohydrate, and sugar intake showed substantial interindividual variability (Table 1).

Table 1

Participant characteristics, performance data, and pre-workout nutrition presented as mean, standard deviation (SD), and range (minimum–maximum). Variables include age, height (centimeters, cm), weight (kilograms, kg), body mass index (BMI), resistance training experience (years, yrs), one-repetition maximum (1RM; kilograms, kg), exercise duration (minutes, min), and pre-workout intake of calories (kilocalories, kcal), carbohydrates (grams, g), and glucose (grams, g). Normality was assessed using the Shapiro–Wilk test (W, p-value).

Variable	Mean $\pm$ SD	Range (Min – Max)	Shapiro-Wilk (W, p)
Participant Characteristics			
Age	23.80 $\pm$ 2.24	21.00–29.00	0.930, .244
Height (cm)	182.27 $\pm$ 7.70	166.00–192.00	0.910, .154
Weight (kg)	75.54 $\pm$ 11.41	56.00–92.00	0.940, .391
BMI	22.68 $\pm$ 2.57	17.99–28.09	0.980, .956
Resistance Workout Experience and Performance			
Resistance Training Experience (yrs)	3.90 $\pm$ 2.63	1.00–10.00	0.900, .108
Bench Press 1RM (kg)	71.91 $\pm$ 22.83	39.38–128.00	0.900, .081
Lat Pulldown 1RM (kg)	83.02 $\pm$ 19.89	52.26–135.00	0.930, .286
Knee Extensions 1RM (kg)	60.61 $\pm$ 18.39	26.67–90.00	0.950, .577
Leg Press 1RM (kg)	206.91 $\pm$ 67.26	115.00–373.00	0.930, .283
Exercise Duration (min)	86.79 $\pm$ 16.67	60.00–110.00	0.940, .397
Pre-Workout Nutrition			
Calories (kcal)	677.73 $\pm$ 334.29	90.00–1300.00	0.950, .698
Carbohydrates (g)	82.55 $\pm$ 34.72	0.50–130.00	0.860, .059
Glucose (g)	25.35 $\pm$ 13.79	0.50–45.00	0.950, .651

Table 2 shows descriptive data for subjective ratings during exercise, post-exercise performance and metabolic outcomes. Mean ratings of perceived exertion and affective responses, calculated across all exercises, did not differ between trials. Figure 2 presents exercise-by-exercise 95% confidence intervals for both outcomes. None of the participants reported nausea or gastrointestinal discomfort during or after exercise, and no adverse events occurred in either condition or period. Post-exercise drop jump performance (reactive strength index (RSI)) and isometric handgrip strength showed no differences between trials. Drop jump ground contact times and jump heights for all three individual repetitions after both trials are indicated in Figure 2. For the dominant leg, participants completed a greater number of knee extension repetitions at 80% 1RM following the intervention trial ($+2.70 \pm 3.68$ repetitions; $t(9) =$

2.32; $p = .046$; $dz = 0.73$). The difference for the non-dominant leg was of similar magnitude but did not reach statistical significance ($+2.40 \pm 3.98$ repetitions; $t(9) = 1.91$; $p = .089$; $dz = 0.60$). Capillary blood lactate concentrations after this test were comparable between conditions. Capillary blood glucose concentrations were higher following the intervention trial compared to the control condition. Figure 3 shows 95% confidence intervals for post-exercise muscular endurance, capillary lactate and glucose. Correlation analysis revealed that differences in glucose concentration between the intervention and placebo conditions (19.0 ± 19.7 mg/dl) were associated with body height ($r = -0.66$, $p = 0.007$) and showed a trend toward an association with body weight ($r = -0.53$, $p = 0.051$) but no association with pre-exercise caloric intake ($r = -0.49$, $p = 0.122$). In contrast, differences in post-exercise knee extension performance of the dominant leg (2.70 ± 3.68 reps) were neither associated with anthropometric or nutritional parameters, nor with the difference in glucose concentration. Analysis of period effects shows a clear effect on perceived exertion ($p = .006$; lower ratings in the second period irrespective of beverage, consistent with the workload-matched session being subjectively easier), a trend for lactate ($p = .059$), but no effect on glucose ($p = .765$).

Table 2

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	81.00–143.00	58.00–100.00	C: 0.92; .199	8.12 to 29.88

Discussion

This exploratory study indicates that ingestion of 60 g of carbohydrates during resistance training was associated with a higher number of knee extension repetitions, reaching statistical significance for the dominant but not for the non-dominant leg, while lactate responses were comparable between conditions. Reactive and isometric strength performance did not differ from the placebo condition. Although participants reported lower perceived exertion following trunk and quadriceps exercises in the carbohydrate condition, omnibus testing of mean session values revealed no significant differences in overall RPE or affective state. Post-exercise glucose concentrations were elevated following carbohydrate supplementation, whereas glucose values in the placebo condition remained within the lower fasting range. Notably, lighter, smaller participants exhibited a greater glycemic response to the fixed carbohydrate dose, suggesting that anthropometric characteristics may partly determine the individual metabolic response. However, this glucose rise was not associated with the corresponding gain in knee extension performance, indicating that the ergogenic effect on muscular endurance is not directly mediated by the extent of glycemic response.

This study applies a matched-workload design and confirms earlier findings on elevated blood glucose based on RCTs with different workloads in the intervention and placebo condition [2, 3]. In contrast to these studies, lactate values were not elevated after training with carbohydrates when the workload is matched. This indicates that an increased number of sets or repetitions, rather than adaptations in aerobic and anaerobic metabolism due to increased substrate availability, might have driven the elevated lactate values reported previously [3].

Contrary to earlier studies based on protocols involving only leg exercises, our data do not confirm a significant effect on perceived exertion [9]. Since descriptive values of perceived exertion indicate lower exertion during abdominal cable crunches and knee extensions but not during leg press or upper body exercises, the subjective benefit of higher carbohydrate availability might be limited to work involving large muscle groups, particularly in isolation exercises. These findings are in line with a recent study on CrossFit training, which likewise confirmed an effect on blood glucose but comparable exertion and no gastrointestinal discomfort during complex exercises [10].

Our findings and those of Trivino et al. indicate that post-exercise muscle force production outcomes, including jumps and isometric handgrip strength, are not beneficially influenced by carbohydrate supplementation [10]. Whereas our study observed a corresponding difference in muscular endurance using knee extensions at 80% 1RM until failure, which was statistically significant for the dominant leg only, Trivino and colleagues reported no effect for deep squats at 70% of body weight [10]. This again suggests that carbohydrate availability may preferentially influence peripheral rather than central fatigue mechanisms.

One of the major limitations of this pilot investigation, along with the relatively small sample size, is the lack of assessments for delayed onset muscle soreness and its impact on subsequent training sessions. Additionally, our exploratory correlational findings suggest a potential influence of anthropometric factors on metabolic responses, which warrants further investigation, including body composition analysis, in adequately powered studies. Furthermore, period and carryover effects could not be formally separated from the intervention effect, because each participant completed only two sessions and all comparisons were based on within-participant differences; residual carryover cannot be entirely excluded despite the washout of at least three days. Since the session performed to volitional fatigue was always the first period, the workload-matching procedure is confounded with period, so that a period or learning effect cannot be distinguished from the effect of matching the workload. Although the two beverages were matched in appearance and taste, the success of participant blinding was not formally assessed, and the trial was single-blind. Capillary glucose and lactate were measured only after exercise, so that the between-condition difference in glucose cannot be related to pre-exercise concentrations. Finally, the muscular endurance test could be evaluated in only 10 of the 15 participants, and the dominant and non-dominant leg were analysed as two separate outcomes without correction for multiplicity; the difference between the two results is small in magnitude and most plausibly reflects the limited number of complete data pairs rather than a genuine side-specific effect, but the muscular endurance finding should be treated as hypothesis-generating. A strength of our study is the differentiation between strength/power and muscular endurance, allowing for a more nuanced assessment of fatigue. Future studies should extend this approach by including muscular endurance testing for additional muscle groups, particularly in the upper body, to determine whether the observed effects generalize beyond the lower body musculature.

Conclusions

Acute carbohydrate ingestion during whole-body resistance training raises blood glucose without increasing lactate at a matched workload, and does not affect maximal strength or power. A difference in muscular endurance was observed, but reached statistical significance for the dominant leg only and should therefore be regarded as preliminary. Although carbohydrate ingestion may be beneficial in everyday training settings without prolonged (≥ 8 h) fasting, the potential benefit may be limited to exercises engaging large muscle groups. Further research is needed to derive individualized recommendations and to clarify the impact of carbohydrate ingestion on delayed onset muscle soreness and performance in subsequent training sessions.

Abbreviations

BMI, body mass index; CHO, carbohydrate; CI, confidence interval; DJ, drop jump; DRKS, German Clinical Trials Register; RPE, rating of perceived exertion; RSI, reactive strength index; SD, standard deviation; 1RM, one-repetition maximum.

Declarations

Ethics approval and consent to participate:

The study was approved by the Ethics Committee of Department 5 (Psychology and Sports Sciences) of the Johann Wolfgang Goethe University Frankfurt am Main, Germany (approval date: 15 February 2026; ID: 2025-79). The study was conducted in accordance with the ethical standards of the Declaration of Helsinki. All participants provided written informed consent prior to participation.

Consent for publication:

Not applicable.

Funding:

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Author Contribution

Conceptualization, T.E. and D.N.; Methodology, T.E. and D.N.; Formal Analysis, T.E.; Investigation, T.E.; Data Curation, T.E.; Writing – Original Draft Preparation, T.E.; Writing – Review & Editing, D.N. and D.G.; Supervision, D.N. and D.G.; Project Administration, D.G.; Resources, D.G. All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials:

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. Details of the trial protocol are available in the German Clinical Trials Register record (DRKS00038810); the full protocol is available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Figures

Enrolment

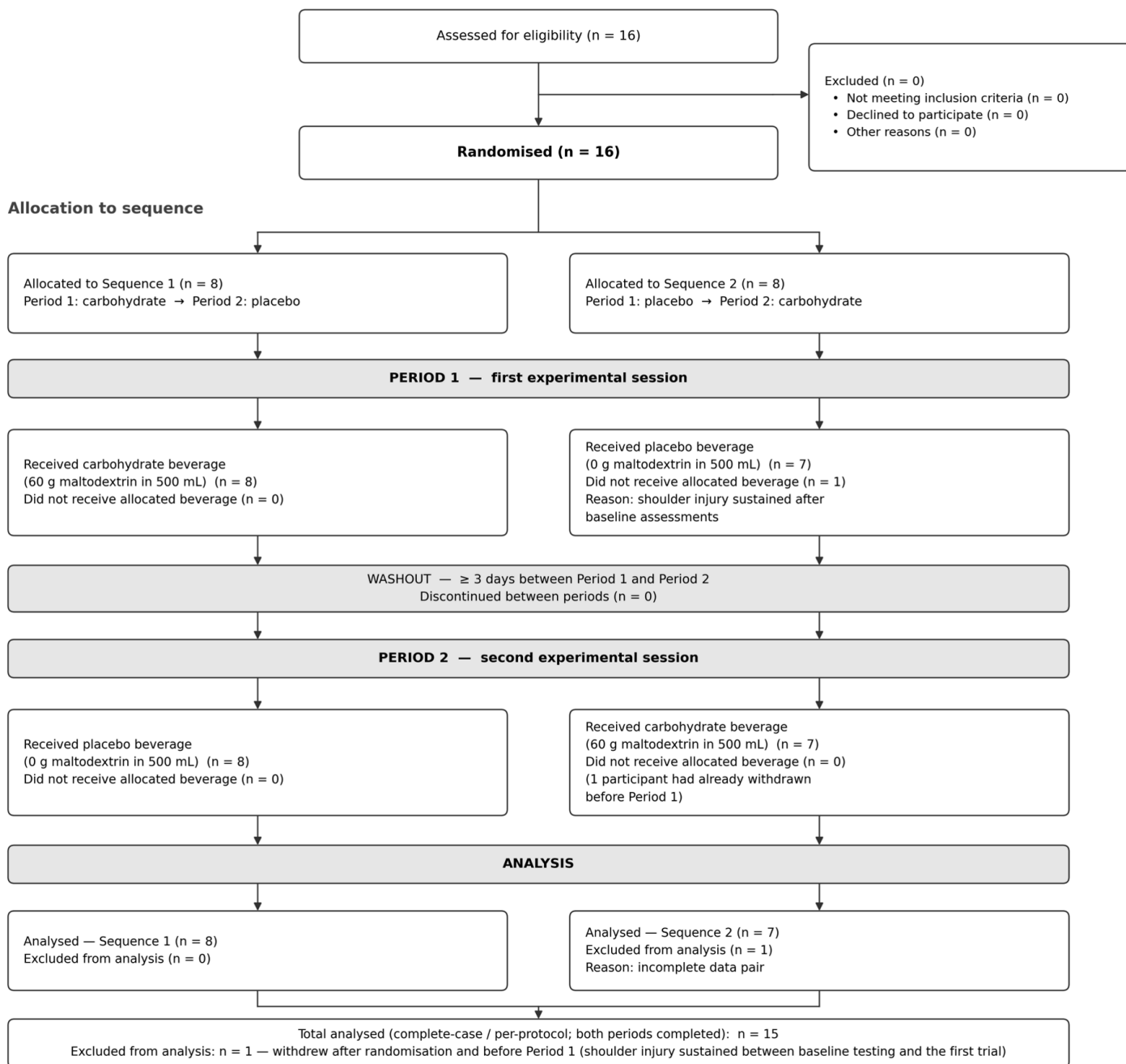


Figure 1

CONSORT flow diagram of the two-period, two-sequence randomised crossover trial. Numbers of participants assessed for eligibility, randomised to each intervention sequence, receiving the allocated beverage in each period, and included in the analysis.

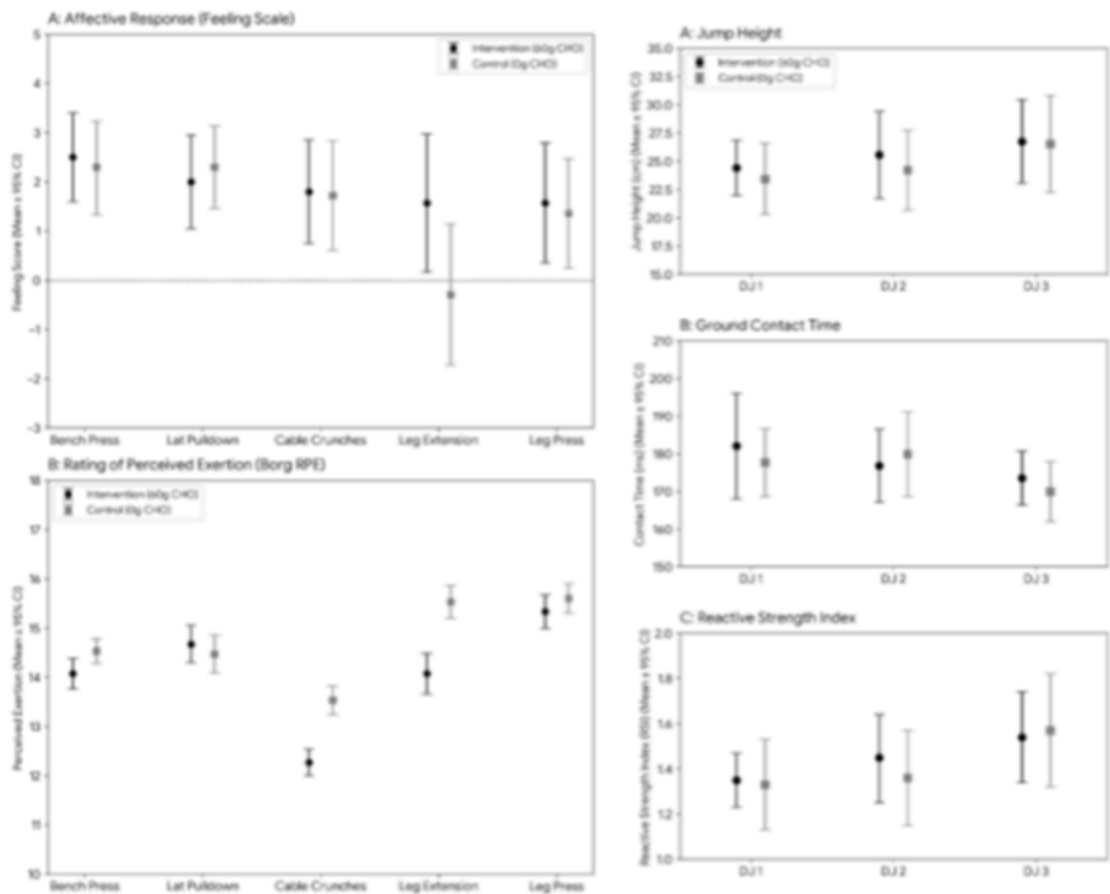


Figure 2

Psychometric responses and reactive strength performance. Data are presented as mean values with error bars representing the 95% confidence interval (CI) for affective response (Feeling Scale), Rating of Perceived Exertion (RPE), jump height (centimeters, cm), ground contact time (milliseconds, ms), and Reactive Strength Index (RSI). The intervention trial (60 grams of maltodextrin; black circles) was compared with the control trial (0 grams of maltodextrin; grey squares) across resistance exercises and three consecutive drop jumps (DJ 1–3). Psychometric measures were recorded during the Bench Press, Lat Pulldown, Cable Crunch, Leg Extension, and Leg Press exercises.

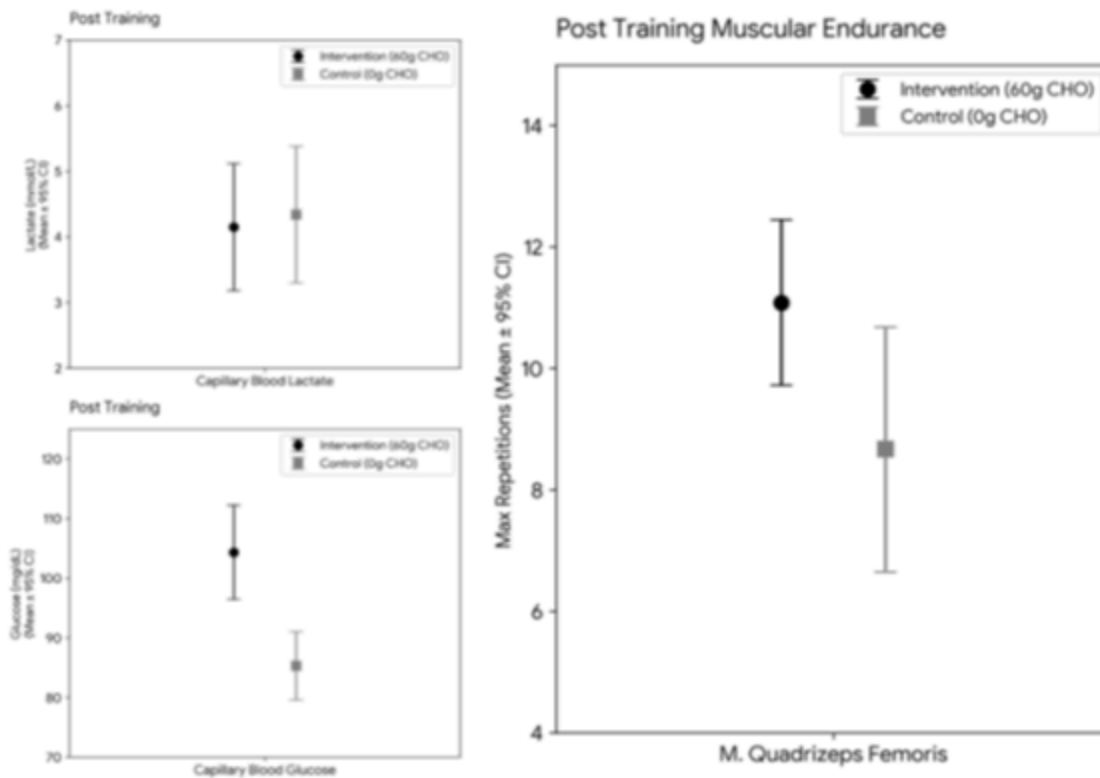


Figure 3

Metabolic response and muscular endurance performance post-exercise. Data are presented as mean values with error bars representing the 95% confidence interval (CI) for capillary blood lactate concentration (millimoles per liter, mmol/L), capillary blood glucose concentration (milligrams per deciliter, mg/dL), and the number of repetitions completed during leg extensions to exhaustion at 80% of the one-repetition maximum (1RM). The intervention trial (60 grams of maltodextrin; black circles) was compared with the control trial (0 grams of maltodextrin; grey squares).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [CONSORT2010CrossoverChecklist1.pdf](#)